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IS 5921-8 (1988): Metal-clad Base Materials for Printed Circuits for Use in Electronic and Telecommunication Equipment, Part 8: Flexible Copper-clad Polyester (PETP) Film [LITD 5: Semiconductor and Other Electronic Components and Devices]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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IS : 5921 ( Part 8 ) - 1988

*Indian Standard*

**SPECIFICATION FOR  
METAL-CLAD BASE MATERIALS FOR  
PRINTED CIRCUITS FOR USE IN  
ELECTRONIC AND TELECOMMUNICATION  
EQUIPMENT**

**PART 8 FLEXIBLE COPPER-CLAD POLYESTER ( PETP ) FILM**

UDC 621·315·619 ( 669·386·8 ) : 621·3·049·75 : 621·38/·39·038

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**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

*Indian Standard*

**SPECIFICATION FOR  
METAL-CLAD BASE MATERIALS FOR  
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ELECTRONIC AND TELECOMMUNICATION  
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**0. FOREWORD**

**0.1** This Indian Standard ( Part 8 ) was adopted ( IEC ):  
by the Bureau of Indian Standards on 27 January 1988, after the draft finalized by the Printed Circuits Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

**0.2** This standard is to be used in conjunction with IS : 5921 ( Part 1 )-1983\* which is a necessary adjunct to this standard.

**0.3** While preparing this standard, assistance has been derived from the following document issued by the International Electrotechnical Commission

IEC Document 52 ( Central Office ) 257  
Draft — Revision of Publication 249-2 :  
Base materials for printed circuits Part 2 :  
Specifications; Specification No. 8 Flexi-  
ble copper-clad polyester ( PETP ) film.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

\*Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment : Part 1 General requirements and tests ( *first revision* ).

\*Rules for rounding off numerical values ( *revised* ).

**1. SCOPE**

**1.1** This standard ( Part 8 ) specifies the requirements for flexible copper-clad polyester ( PETP ) film for use in printed wiring in telecommunication and allied electronic equipment.

NOTE — The specification includes optional requirements which apply only by agreement between the purchaser and the supplier.

**2. TERMINOLOGY**

**2.1** For the purpose of this standard, the terms and definitions as given in IS : 1885 ( Part 6 )-1978\* shall apply.

**3. MATERIALS AND CONSTRUCTION**

**3.0** The material consists of an insulating flexible polyester film base with copper foil bonded to one or both sides, with or without the use of an adhesive.

\*Electrotechnical vocabulary : Part 6 Printed circuits ( *first revision* ).

**3.1 Insulating Base**

**3.1.1 Polyester Film** — Polyester film ( polyethylene terephthalate ) of preferred thicknesses and permitted deviations as given below when measured by the method of IS : 5921 ( Part 1 )-1983\*.

<i>Nominal Thickness</i> $\mu\text{m}$	<i>Maximum Permitted Deviation at Any Point</i>
12	} $\pm 15\%$
23	
36	
50	
75	
100	
125	

**3.1.2 Bonding Medium** — A layer of adhesive may be used between the polyester film and the metal foil.

\*Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment: Part 1 General requirements and tests ( *first revision* ).

**3.2 Metal Foil — Copper**, as specified in IS : 10922-1984\*.

**3.3 Preferred Combinations of Copper Foil and Polyester Film** — The nominal thicknesses given Table 1 assume the presence of an adhesive layer 15  $\mu\text{m}$  thick between the copper and the film, and will thus need adjusting for any other thickness of adhesive.

**4. MARKING**

**4.1** The marking shall be in accordance with 3 of IS : 5921 ( Part 1 )-1983†. If letters or numbers are used, these shall be upright in the machine direction as shown in Table 2.

**5. TESTS**

**5.1** The provisions of 4 of IS : 5921 ( Part 1 )-1983\* shall apply except as modified by 5.1.1. The methods of tests shall be as described in IS : 5921 ( Part 1 )-1983†.

**5.1.1 Acceptance Tests** — The tests specified in 4.1.2 of IS : 5921 ( Part 1 )-1983† shall be carried out as acceptance tests. The sampling plans and acceptance levels may be agreed upon between the purchaser and the supplier.

**5.1.2 Routine Tests** — The following tests may be carried out as routine tests:

- a) Visual examination, and
- b) Dimensions and tolerances.

\*Specification for copper foil for use in the manufacture of copper-clad base materials.

†Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment : Part 1 General requirements and tests ( first revision ).

**6. ELECTRICAL PROPERTIES**

**6.1** The electrical properties shall meet the requirements as given in Table 3.

**7. NON-ELECTRICAL PROPERTIES OF COPPER-CLAD FILM**

**7.0** When material is supplied in roll form, the requirements of 7.1 and 7.2 shall apply only to material which is farther than 6 mm from each edge.

**7.1 Appearance of Copper-Clad Face**

**7.1.1 Normal Surface Finish** — The copper-clad face shall be substantially free from blisters, wrinkles, pin holes, deep scratches, pits and adhesive. Any discoloration or contamination shall be readily removable with hydrochloric acid solution of density 1.02  $\text{g/cm}^3$ , or with a suitable organic solvent.

**7.1.2 High-Quality Surface Finish ( Optional )** — If a surface of high quality is essential for precious metal plating or fine line etching, the following requirements shall apply in addition to those of 7.1.1 when agreed upon between the purchaser and the supplier and when inspected in accordance with 6.2 of IS : 5921 ( Part 1 )-1983\*:

- a) The surface of the copper foil shall be free from scratches of depth greater than 10  $\mu\text{m}$ . The total length of scratches of depth greater than 5  $\mu\text{m}$  but less than or equal to 10  $\mu\text{m}$  shall not exceed 1  $\text{m/m}^2$  of the copper surface.

\*Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment : Part 1 General requirements and tests ( first revision ).

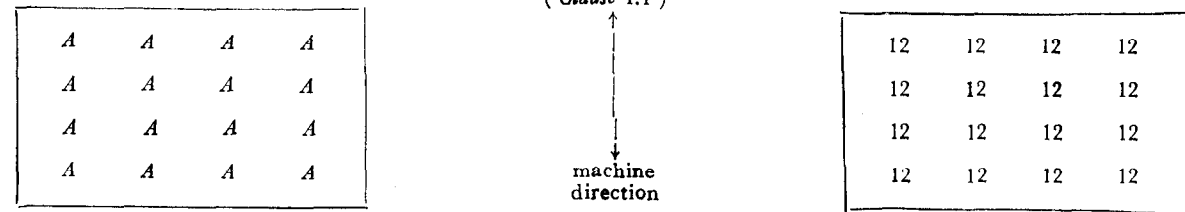
**TABLE 1 PREFERRED THICKNESSES OF COMBINATION OF COPPER FOIL AND POLYESTER FILM**

( Clause 3.3 )

	COPPER FOIL		POLYESTER FILM THICKNESS ( $\mu\text{m}$ )						
	Nominal Thickness ( $\mu\text{m}$ )	Mass per Unit Area ( $\text{g/m}^2$ )	12	23	36	50	75	100	125
Foil one side	{ 18	152	—	56	—	—	—	—	—
	{ 35	305	—	—	86	100	125	150	175
	{ 70	610	—	—	—	135	160	—	210
Foil both sides	{ 18	152	—	89	—	—	—	—	—
	{ 35	305	—	—	—	150	175	—	225
	{ 70	610	—	—	—	220	245	—	295

**TABLE 2 MACHINE DIRECTION**

( Clause 4.1 )



NOTE — This requirement applies to the surface of 35  $\mu\text{m}$  and 70  $\mu\text{m}$  ( 305 and 610  $\text{g}/\text{m}^2$  respectively ) foils. Permitted scratches on surfaces of 18  $\mu\text{m}$  ( 152  $\text{g}/\text{m}^2$  ) foil are still under consideration.

- b) The total area of all pin-holes in an area of 0.5  $\text{m}^2$  shall not exceed 0.012 mm; and
- c) No material shall have more imperfections of the types listed than those permitted in Table 4.

**TABLE 3 ELECTRICAL PROPERTIES**  
( Clause 6.1 )

Sr. No.	PROPERTY	TEST METHOD [ CL OF IS : 5921 ( PART 1 ) - 1983* ]	REQUIREMENTS
(1)	(2)	(3)	(4)
1.	Resistance of foil	5.1	As specified in IS : 10922-1984†
2.	Surface resistance after damp heat and recovery	5.2	100 000 $\text{M}\Omega$ , Min
3.	Volume resistivity after damp heat and recovery	5.2	1 000 000 $\text{M}\Omega\text{m}$ Min on films clad both sides only
4.	Relative permittivity after damp heat and recovery	5.4	4.0, Max
5.	Dielectric dissipation factor after damp heat and recovery	5.4	0.035, Max
6.	Electrical strength normal to plane of sheet ( optional )		25 kV/mm

\*Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment : Part I General requirements and tests ( first revision ).  
†Specification for copper foil use in the manufacture of copper-clad base materials.

**7.2 Inclusions Between Film and Copper**

**7.2.1** There shall be no more areas of delamination observed between film and copper, caused by the inclusions of air or foreign matter than those permitted in Table 5, when the material is inspected in accordance with 6.2 of IS : 5921 ( Part 1 )-1983\*.

**7.3 Thickness** — The thickness of the copper-clad film shall not differ at any point from the sum of the nominal thicknesses of its component layers by more than the permitted percentage deviation allowed in 3.1.1 for the film used.

For the preferred combinations of copper and film using adhesive layers 15  $\mu\text{m}$  thick, the total nominal thicknesses are shown in 3.3.

\*Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment: Part I General requirements and tests ( first revision ).

**TABLE 4 PERMITTED IMPERFECTIONS IN A HIGH QUALITY COPPER SURFACE**  
[ Clause 7.1.2(c) ]

TYPES	SIZES IN mm ( LENGTH UNLESS OTHERWISE SHOWN )		MAXIMUM NUMBER OF IMPERFECTIONS PERMITTED	
	Above	Not Above	In Any Area of 1 $\text{m}^2$	In Any Area of 0.1 $\text{m}^2$
Inclusions in copper surface	0	0.1	Any number	Any number
	0.1	0.25	30	4
	0.25		0	0
Indentations* ( see Note 2 )	0	0.25	Any number	Any number
	0.25	3.0		
	0.5	or width	30	7
	1.25	1.0	11	3
	3.0		3	1
	or width		0	0

NOTE 1 — For cut panels smaller than 0.1  $\text{m}^2$  in area, the number and the maximum sizes of imperfections shall be as agreed upon between the purchaser and the supplier.

NOTE 2 — The maximum permitted number of indentations in any area of 1  $\text{m}^2$  with length greater than 0.25 mm is 30, of which none shall exceed a length of 3.0 mm or width of 1.0 mm, 3 may exceed a length of 1.25 mm and 11 may exceed a length of 0.5 mm.

**7.4 Solderability** — Under consideration.

**7.5 Other Properties of Copper-Clad Film** — These properties are specified in Table 6.

**8. PACKAGING** — Material supplied either in roll, sheet or panel form shall be adequately packed in cases or crates to avoid damage and contamination during transit and storage.

**9. ADDITIONAL REQUIREMENTS**

**9.1 For Material Supplied in Roll Form**

**9.1.1** Material supplied in roll form shall be firmly reeled on formers of internal diameter not less than 50 mm, and as agreed between the purchaser and the supplier.

**9.1.2** The deviation from the normal width of material supplied in rolls, as manufactured, shall not exceed  $\pm 25$  mm.

**9.1.3** The deviation from the normal width of material supplied in rolls cut to specified width shall not exceed + 3 mm.  
0

**9.1.4** The deviation in length of material supplied in rolls shall not exceed  $\pm 1$  percent of the nominal length.

**TABLE 5 PERMITTED INCLUSIONS BETWEEN FILM AND COPPER**

( Clause 7.2.1 )

MAXIMUM DIMENSION DELAMINATED AREA (mm)		MAXIMUM PERMITTED NUMBER OF INCLUSIONS			
		Normal Standard		High-Quality, Standard (Optional)	
Above	Not Above	In any area of 1 m <sup>2</sup>	In any area of 0.1 m <sup>2</sup>	In any area of 1 m <sup>2</sup>	In any area of 0.1 m <sup>2</sup>
0	0.25	Any number	Any number	Any number	Any number
0.25	0.5	Any number	Any number	150	30
0.5	1.0	150	30	30	8
1.0	2.0	25	5	10	2
2.0	—	0	0	0	0

NOTE 1 — For any panels smaller than 0.1 m<sup>2</sup> in area, the number and maximum sizes of delaminated areas permitted shall be as agreed to between the supplier and the purchaser.

NOTE 2 — For materials supplied, in roll form, material failing to meet the requirements of 7.1 and 7.2 may be left on the roll to avoid the need for cutting and splicing provided that failed lengths which shall be considered to be not less than 0.3 m in length, are clearly marked with a 'flag' which shall be visible from the edge of the roll, and provided also that failed lengths are not included in any statement of materials quantity claimed to meet this specification.

**9.1.5** There shall be no more than two splices in any 100 m length of a roll except that in material slit to specified width, there shall be no more than five splices in any 100 m length.

**9.2 For Material Supplied in Sheet Form —**  
The deviation in length and width for sheets cut to specified size shall not exceed  $\begin{matrix} 3 \\ 0 \end{matrix}$  mm.

**TABLE 6 NON-ELECTRICAL PROPERTIES**

( Clause 7.5 )

Sr. No.	PROPERTY	TEST METHOD [ CLAUSE OF IS : 5921 ( PART 1 ) - 1983* ]	REQUIREMENTS
(1)	(2)	(3)	(4)
1.	Peel strength as received	6.10.1	0.5 N/mm, <i>Min</i>
2.	Peel strength after dry heat for 30 min at 125°C ( optional )	6.10.5	0.5 N/mm, <i>Min</i> No blistering or delamination
3.	Peel strength after dry heat for 500 h at 100°C ( optional )	6.10.5	0.5 N/mm, <i>Min</i> No blistering or delamination
4.	Retention of peel strength after immersion in 1.1.1 trichlorethane and isopropyl alcohol	6.10.6	75 percent, <i>Min</i> No blistering, delamination, tackiness, or colour change
5.	Retention of peel strength after simulated plating ( optional )	6.10.7	75 percent, <i>Min</i>
6.	Dimensional change due to etching	6.5	5.0 mm/m, <i>Max</i> , in either direction
7.	Dimensional change due to etching and heating ( optional )	6.5	As agreed between the supplier and the purchaser
8.	Flexural fatigue ( optional )	7.1	As agreed between the supplier and the purchaser

\*Specification for metal-clad base materials for printed circuits for use in electronic and telecommunication equipment : Part 1 General requirements and tests ( *first revision* ).



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